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IN-76

STUDIES IN ELECTRON PHENOMENA IN MOS STRUCTURES

- THE PULSED C-V METHOD

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SUMMARY

C-V methods for the investigation of electron phenomena in MOS structures have shown great advances as the theory of the semiconductor-oxide interface developed.

From 1962 to about 1975 attention was concentrated on quasiequilibriumC-V methods,i.e. the H-F C-V method and the LF C-V method. The pulse C-V method was used mainly for the investigation of the transients in MOS capacitance caused by minority charge carriers. The most noticable attempt to use the pulse technique for the surface state measurements was made by Muller and Shick in 1970.

Recently, owing to the development of the theory of MOS structures and experimental techniques, the C-V method has been further developed. For example, deep level pulse spectroscopy and also the pulse hysteresis C-V method originated by the author of this work. The latter is presented and developed in this thesis. The pulse hysteresis C-V method provides a straight-forward technique for measuring the change of various charges in MOS structures and a tool for investigating the kinetics of various electron phenomena. For example, the pulse hysteresis C-V method can be used for measuring the energy distribution and kinetics of surface states with the resolution of about 5×10^{-9} cm eV^{-1}.

A theoretical investigation is also presented of some transients in an MOS structure, particularly, the thermal generation of minority charge carriers via surface states and the relaxation of minority charge carriers supplied from the inversion layer outside the MOS structure. This investigation resulted in derivation of the analytical expressions which clearly present the physics of those electron phenomena.